BTEC Assignment Brief

Qualification	Pearson BTEC International Level 3 Diploma in Engineering (optional unit) Pearson BTEC International Level 3 Diploma in Mechanical Engineering (optional unit) Pearson BTEC International Level 3 Diploma in Aeronautical Engineering (optional unit) Pearson BTEC International Level 3 Extended Diploma in Engineering (optional unit) Pearson BTEC International Level 3 Extended Diploma in Mechanical Engineering (optional unit) Pearson BTEC International Level 3 Extended Diploma in Manufacturing Engineering (optional unit) Pearson BTEC International Level 3 Extended Diploma in Aeronautical Engineering (optional unit)
Unit number and title	**Unit 29: Principles and Applications of Fluid Mechanics**
Learning aim(s)	**A:** Examine the application of static fluid principles that power hydrostatic and pneumatic components and systems
Assignment title	1 Application of static fluid principles
Assessor	
Issue date	
Hand in deadline	

Vocational Scenario or Context	You have successfully completed part of an apprenticeship with a company that supplies components and equipment for pneumatic, hydraulic and propulsion devices and systems. Your latest placement in the company is with the Design Department. The Department is responsible for designing bespoke solutions for customers as well as standard components and systems. You will be working with a Senior Design Engineer who has identified some knowledge and skills that you need to develop before you can understand customer requirements and apply them to the selection of components and incorporating them into systems.

Task 1	You have been asked to investigate the nature of fluids, the analysis of static fluid principles and their application in hydrostatic and pneumatic components and systems. **To do this:** Your tutor will provide you with some information about a range of gases and fluids. You will use these to evaluate the application of hydrostatic and pneumatic fluid principles in

order to determine system parameters.

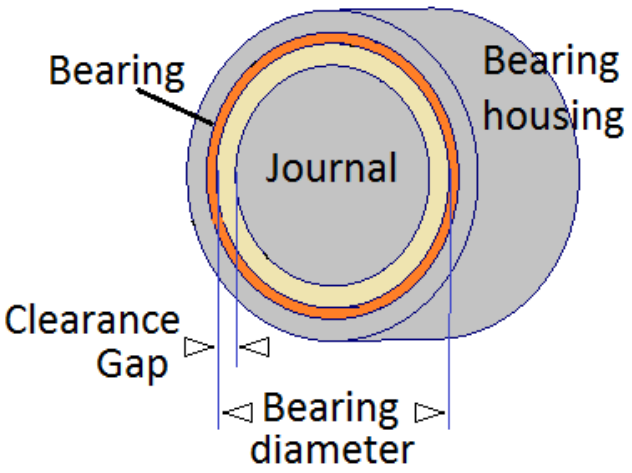
Firstly you will need to explain and analyse properties and characteristics of the gases and fluids and how they affect their use as fluid power mediums. You should include information about mass, weight, density, pressure, compressibility, viscosity, surface tension and the characteristics of Newtonian fluids.

You should also:

Explain hydrostatic and pneumatic fluid principles, and then solve the following problems using the values provided by your tutor.

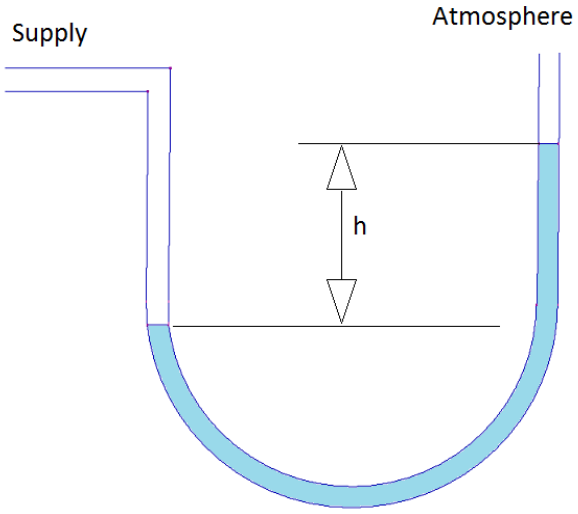
1. A storage tank is w metre wide. It contains a liquid with density ρ kg/m^3 to a depth of h metre. Calculate the hydrostatic thrust on the side of the tank, and its position from the surface of the liquid.
2. A ball of mass m kg and diameter d metre is held fully underwater (density 1000 kg/m^3.) Calculate
    a. the upthrust on the ball
    b. the density of the ball
    c. the percentage of the ball above the surface of the water if it is allowed to float
3. A journal runs in a bearing diameter, 25mm, and length 100 mm. The clearance gap is 0.8 mm. The lubricant used has a dynamic viscosity of 80 cP. The bearing must carry a side load of 800N. Calculate the values of
    a. the friction force
    b. coefficient of friction

    Note: 1cP = 1mPa.s



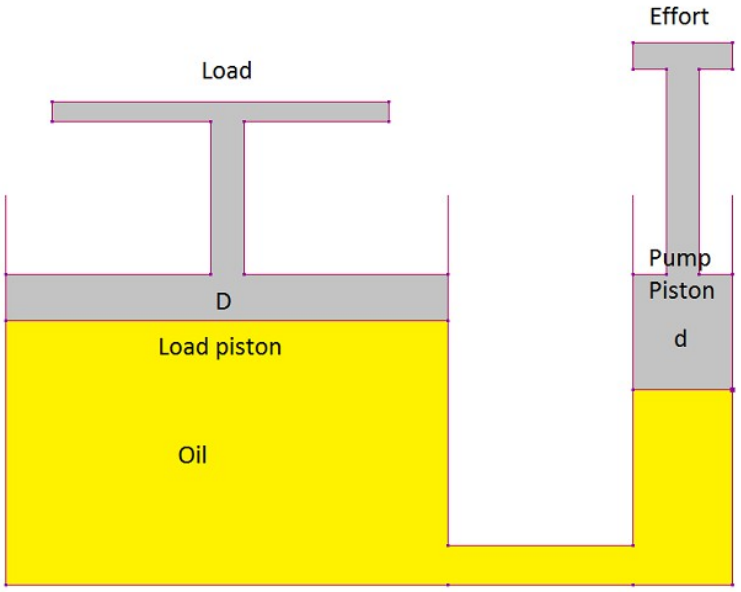
4. A manometer is used to measure the gas pressure

supply to a boiler. One side is connected to the supply and the other is open to the atmosphere. The manometer contains water (density 1000 kg/m^3). Calculate the gauge pressure if the head is h mm.



How would you find the absolute pressure of the gas supply?

5. A simple hydraulic jack has a pump piston diameter d, and a load piston D. Calculate
   a. the effort force needed to lift a load of L Newton
   b. The distance moved by the load if the effort moves a distance h_1.



6. An air compressor works with a compression ratio R. If the incoming air is at a pressure of 1 bar and temperature of 20°C, calculate the final air pressure

	if the final temperature is T_2°C. Note: 1bar = 100x10^{3}Pa 7. Explain briefly why a gas has two specific heat capacities. N kg of a gas is heated from T_1°C to T_2°C. The specific heat capacity of the gas at constant volume is c_v=0.72 kJ/kgK and the specific heat capacity at constant pressure c_p=1.01 kJ/kgK. Calculate the change in a. Enthalpy b. Internal energy c. Flow energy 8. Explain the difference between an isothermal and an adiabatic expansion of a gas. V_1 m^3 of the gas in question 7 at a pressure of 1 bar is compressed to V_2 m^3 in an adiabatic change. Calculate the: a. ratio of the specific heat capacities γ b. final pressure
Checklist of evidence required	A report containing: • calculated values • graphs • comparison with published values • solutions to the problems about the nature of fluids, the analysis of static fluid principles and their application in hydrostatic and pneumatic components and systems. The solutions should be • logically structured • well presented, with • explanations of how hydrostatic and pneumatic fluid principles are applied in determining parameters.

Criteria covered by this task:	
Unit/Criteria reference	To achieve the criteria you must show that you are able to:
29/A.D1	Evaluate, using language that is technically correct and of a high standard, the application of hydrostatic and pneumatic fluid principles to determine hydrostatic and pneumatic system parameters.
29/A.M1	Analyse the properties and characteristics of gases and liquids and how

	they affect their use as fluid power mediums.
29/A.M2	Analyse hydrostatic and pneumatic fluid principles and their application to determine hydrostatic and pneumatic component and system parameters.
29/A.P1	Explain the properties and characteristics of gases and liquids and how they affect their use as fluid power mediums.
29/A.P2	Explain hydrostatic and pneumatic fluid principles and apply them to determine hydrostatic and pneumatic component and system parameters.

Sources of information to support you with this Assignment	Books BTEC Level 3 National Engineering Student Book (Level 3 BTEC National Engineering); Buckenham et al; Pearson Education (2010); **ISBN-13:** 978-1292141008 Mechanical Engineering; Darbyshire A; Routledge (2010); ISBN-13: 978-0080965772 Mechanical Engineering Principles; Bird, Ross; Routledge (2014); **ISBN-13:** 978-1138781573 Websites miniphysics.com/a-level-physics-revision-notes-junior-college-physicsh1-h2.html freestudy.co.uk Above are some examples of websites. Further useful resources may be found at qualifications.pearson.com/en/support/published-resources.html#step1
Other assessment materials attached to this Assignment Brief	Instructions for the safe performance of practical investigations. A formula sheet containing all relevant formulae to cover the unit content for Learning Aim A. A table of values for learners to use with the problems.